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(54) **Heat exchanger for painting system drying ovens**

(57) A heat exchanger (1), particularly for painting system drying ovens, comprises an air stream burner (3) supplied with a fuel gas which is mixed with recovery air coming from an oven, thereby providing a combus-

tible mixture which can be ignited; the ignited mixture is caused to pass inside a tube sheet assembly (6,7), therethrough outside air is conveyed to be heated and sent to the oven.

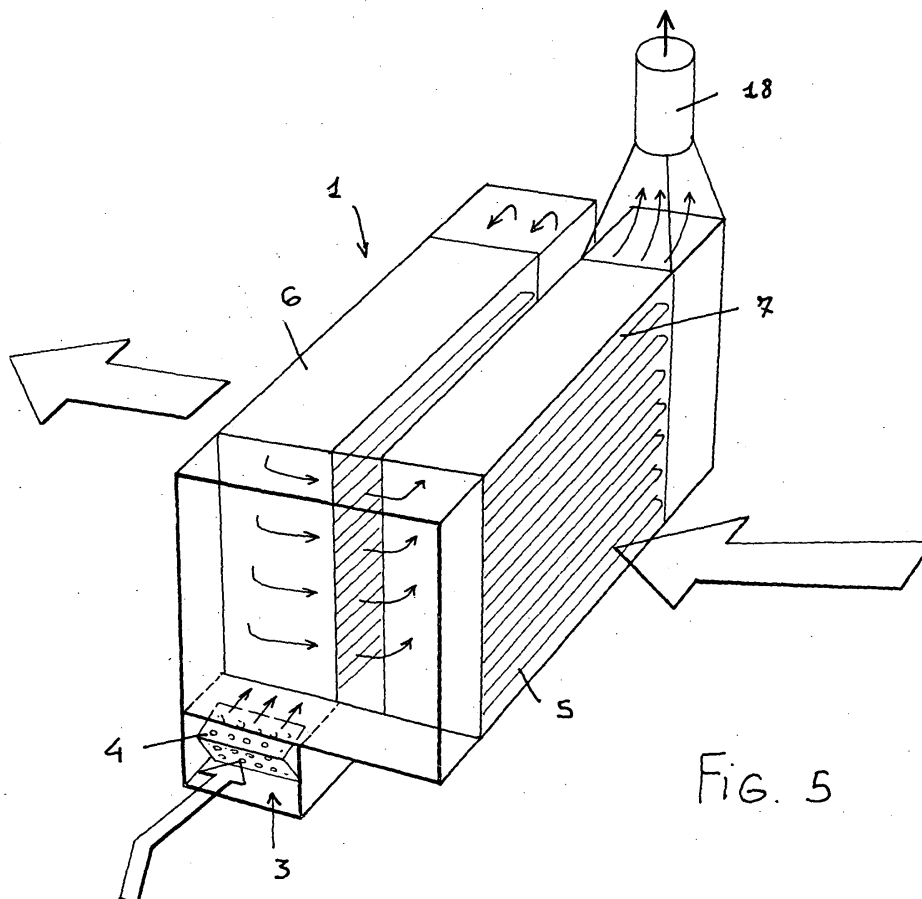


Fig. 5

Description

BACKGROUND OF THE INVENTION

[0001] The present invention relates to a heat exchanger, specifically designed for painting system drying ovens.

[0002] As is known, in painting system drying ovens, heated air for drying the painted articles is conventionally used, which air, however, also contacts the paint solvents.

[0003] Thus, the outlet air from a drying oven contains solvents and other polluting substances, and, accordingly, it cannot be discharged to the outside environment, without a proper processing operation.

SUMMARY OF THE INVENTION

[0004] The aim of the present invention is to provide a heat exchanger designed for improving the power recovery of the painting system, and specifically adapted to burn solvent materials coming from the drying oven.

[0005] This result is achieved by using an air stream burner, of a low temperature type, i.e. operating at a temperature from 450°C to 650°C.

[0006] The burner uses as burning air that air which is withdrawn from the ovens, recovering its heat and burning the solvent materials.

[0007] Within the scope of the above mentioned aim, a main object of the present invention is to provide such a heat exchanger which is very efficient and reliable in operation.

[0008] Another object of the present invention is to provide such a heat exchanger which can also be applied to existing painting systems.

[0009] According to one aspect of the present invention, the above mentioned aim and objects, as well as yet other objects, which will become more apparent hereinafter, are achieved by a heat exchanger, specifically for painting system drying ovens, characterized in that said heat exchanger comprises an air stream burner supplied with a fuel gas which is mixed with recovery air coming from an oven, thereby providing a combustible mixture which is ignited, the ignited mixture being caused to pass inside a tube sheet arrangement, there-through outside air to be heated and supplied to the oven is conveyed.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010] Further characteristics and advantages of the present invention will become more apparent hereinafter from the following disclosure of a preferred, though not exclusive, embodiment of the invention, which is illustrated, by way of an indicative but not limitative example, in the accompanying drawings, where:

Figure 1 is an elevation view of the heat exchanger

according to the invention;

Figure 2 is a side view, as longitudinally cross-sectioned, of the heat exchanger and burner according to the present invention;

Figure 3 is a longitudinally cross-sectioned front view of the heat exchanger and burner;

Figure 4 is a side elevation view of the heat exchanger according to the invention; and

Figure 5 is a perspective view of the heat exchanger according to the invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

[0011] With reference to the number references of the above mentioned figures, the heat exchanger according to the invention, which has been generally indicted by the reference number 1, is used in a drying oven of a painting system, for example for painting motor vehicle, to which hot or heated air is supplied.

[0012] The heat exchanger 1 comprises an air stream burner 3, including a plurality of perforated plates 4, thereinto is conveyed a gas, methane or GPL to be mixed with recovery air coming from the oven, thereby providing a combustible mixture which is ignited by igniting electrodes.

[0013] The ignited mixture is caused to pass inside a tube sheet arrangement, comprising a plurality of tubes 5 having preferably an oval cross-section, therethrough is conveyed air coming from the outside or inside environment, to be heated and supplied to the drying oven.

[0014] More specifically, the tube sheet assembly comprises two tube sheets, respectively indicated by the reference numbers 6 and 7, which are coupled in a series relationship, thereby causing the ignited mixture coming from the burner 3 to pass through the first tube sheet 6 and then the second tube sheet 7, to be finally discharged from a chimney or stack 18.

[0015] The air to be heated coming from the outside environment affects the second tube sheet arrangement 7, then the first tube sheet arrangement 6 and, heated to a set temperature, is supplied to the drying oven through a delivery duct 8.

[0016] Air to be heated is taken either from the outside environment or from the inside of the drying oven, by a centrifugal type of fan 9, and is supplied to the tube sheet arrangements through an air supplying duct 10.

[0017] The burner 3 is arranged in a duct, coupled to the drying oven so that the air stream is constituted by recovery air coming from the drying oven.

[0018] This air, containing solvents removed from the painting materials, is burnt thereby eliminating said solvents, which are not discharged to the outside environment.

[0019] Downstream of the burner 3, a thermally insulated channel 11, arranged under the heat exchanger, supplies a first fume distributing plenum 12 for distributing the fumes through the tube sheet arrangement.

[0020] The temperature of the recovery air coming

from the drying oven is of about 180°, this value being indicated by way of an indicative example.

[0021] The fumes from the stack are discharged at a temperature of about 230°C.

[0022] Air to be heated coming from the air fan has a temperature of about 180°C and, after having passed through the tube sheet arrangements, it is supplied to the drying oven at a temperature of about 230°C.

[0023] If air is taken from the outside environment, then its temperature will be brought from 20°C to 180°C, whereas the burning air flow or stream supplying the burner, is decreased from a value of 180°C at the inlet to a temperature of about 150°C at the outlet.

[0024] It has been found that the invention fully achieves the intended aim and objects.

[0025] In fact, the invention provides a heat exchanger allowing to burn solvent materials entrained by outlet air coming from the drying oven, thereby preventing said solvent materials from polluting the environment, while providing a power recovery through the overall system.

[0026] In practicing the invention, the used materials, as well as the continent size and shapes can be any, according to requirements and the status of the art.

Claims

1. A heat exchanger, specifically for painting system drying ovens, **characterized in that** said heat exchanger comprises an air stream burner supplied with a fuel gas which is mixed with recovery air coming from an oven, thereby providing a combustible mixture which is ignited, the ignited mixture being caused to pass inside a tube sheet arrangement, therethrough outside air to be heated and supplied to the oven is conveyed. ,
2. A heat exchanger, according to claim 1, **characterized in that** said air stream burner comprises a plurality of perforated plates therethrough is conveyed gas, methane or GPL, to be mixed with recovery air from the drying oven, thereby providing said combustible mixture, which is ignited by igniting electrodes.
3. A heat exchanger, according to claim 1 or 2, **characterized in that** said tube sheet arrangement comprises a plurality of tubes having an oval cross-section, therethrough outside air to be heated and supplied to said drying oven is conveyed.
4. A heat exchanger, according to one or more of the preceding claims, **characterized in that** said tube sheet arrangement comprises two or more tube sheet assemblies coupled with a series relationship, thereby the ignited mixture coming from said burner passes through the first tube sheet assembly and then through the second tube sheet assembly to be discharged from a discharging stack.
5. A heat exchanger, according to one or more of the preceding claims, **characterized in that** the outside air to be heated affects the second tube sheet assembly, then the first tube sheet assembly and, upon heating to a set temperature, is supplied to said drying oven through an air delivery duct.
6. A heat exchanger, according to one or more of the preceding claims, **characterized in that** the air to be heated is taken either from the outside of the oven or from the inside of said oven through a centrifugal fan and being supplied to said tube sheet assemblies through an air supplying duct.
7. A heat exchanger, according to one or more of the preceding claims, **characterized in that** said burner is arranged in a burner duct coupled to said drying oven, so that the air stream comprises recovery air coming from said drying oven containing solvent materials removed from the painting materials.
8. A heat exchanger, according to one or more of the preceding claims, **characterized in that**, downstream of said burner, a thermally insulated channel, arranged under said heat exchanger, supplies a first distribution plenum for distributing fumes through the tube sheet assemblies.
9. A heat exchanger, according to one or more of the preceding claims, **characterized in that** said recovery air coming from said drying oven has a temperature of about 180°C, and said fumes are discharged at a temperature of about 230°C.
10. A heat exchanger, according to one or more of the preceding claims, **characterized in that** said air to be heated coming from said fan has a temperature of about 180°C and, upon passing through said tube sheet assemblies, is supplied to said oven at a temperature of about 230°C.
11. A heat exchanger, according to one or more of the preceding claims, **characterized in that**, in a case in which outside air is used, said outside air, at a temperature of substantially 20°C, is brought to a temperature of 180°C, the burning air stream supplying said burner having a temperature of 180°C at the inlet of said burner and a temperature of about 150°C at the outlet of said burner.
12. A heat exchanger, according to one or more of the preceding claims, **characterized in that** said heat exchanger comprises one or more of the disclosed and/or illustrated features.

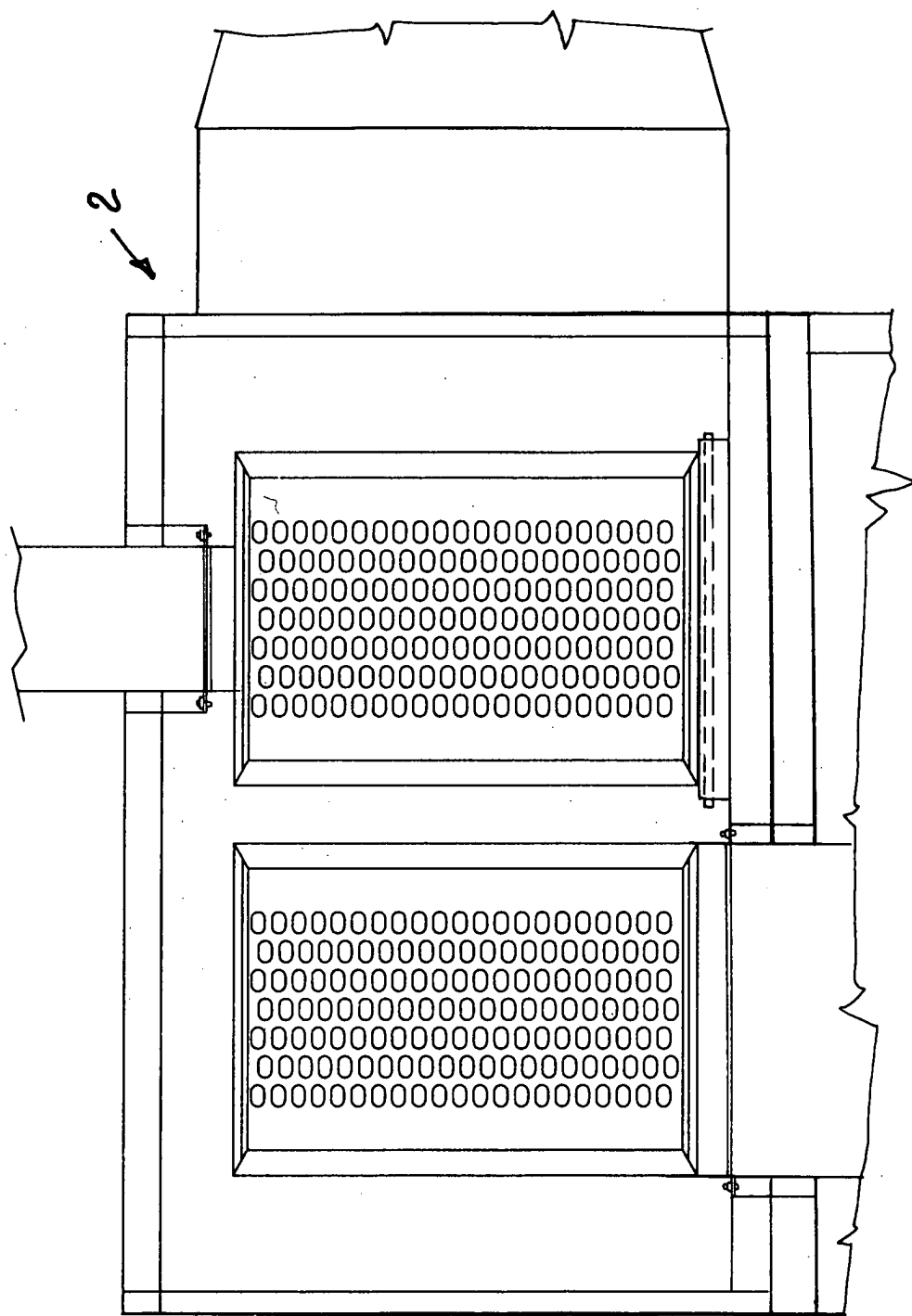


FIG. 1

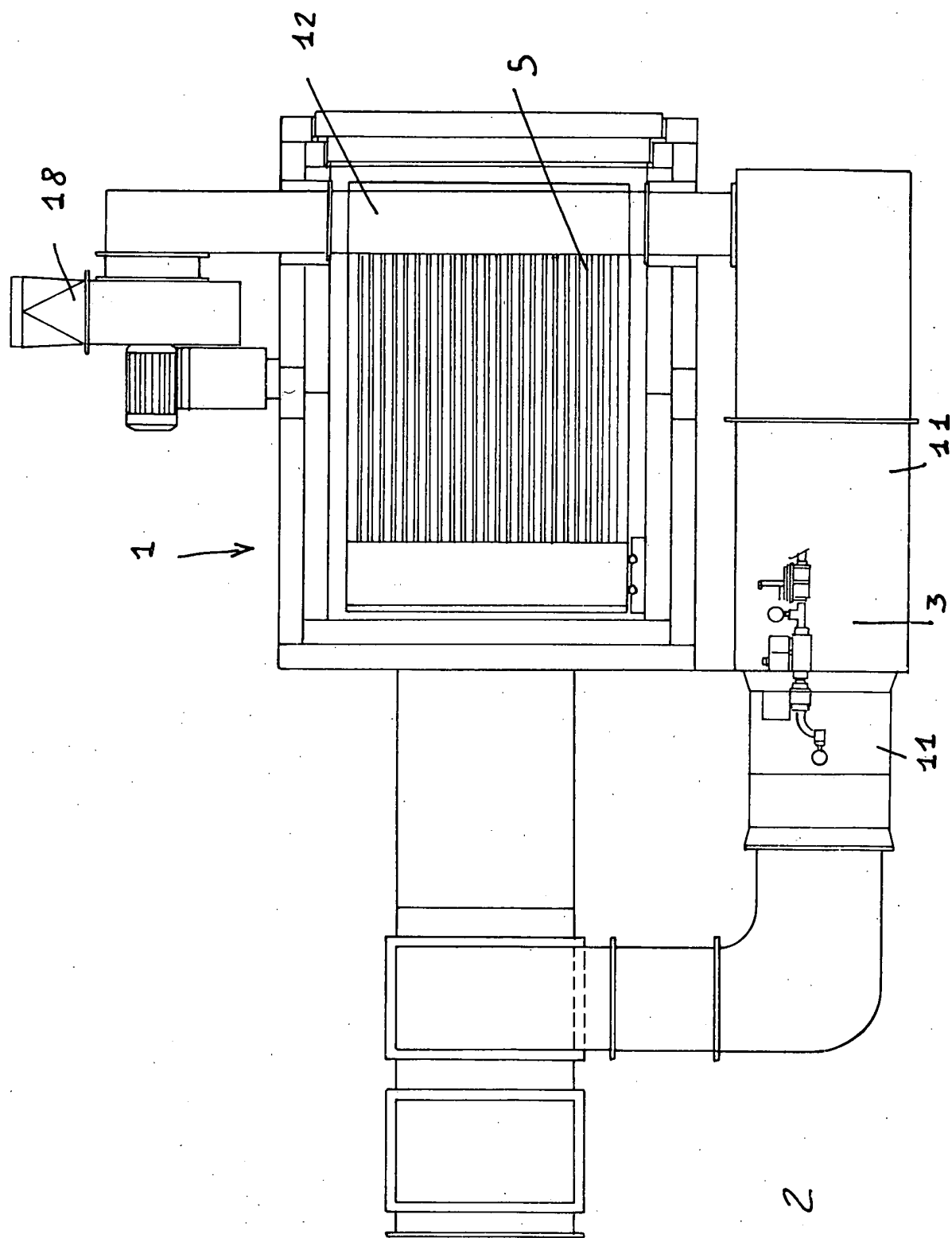
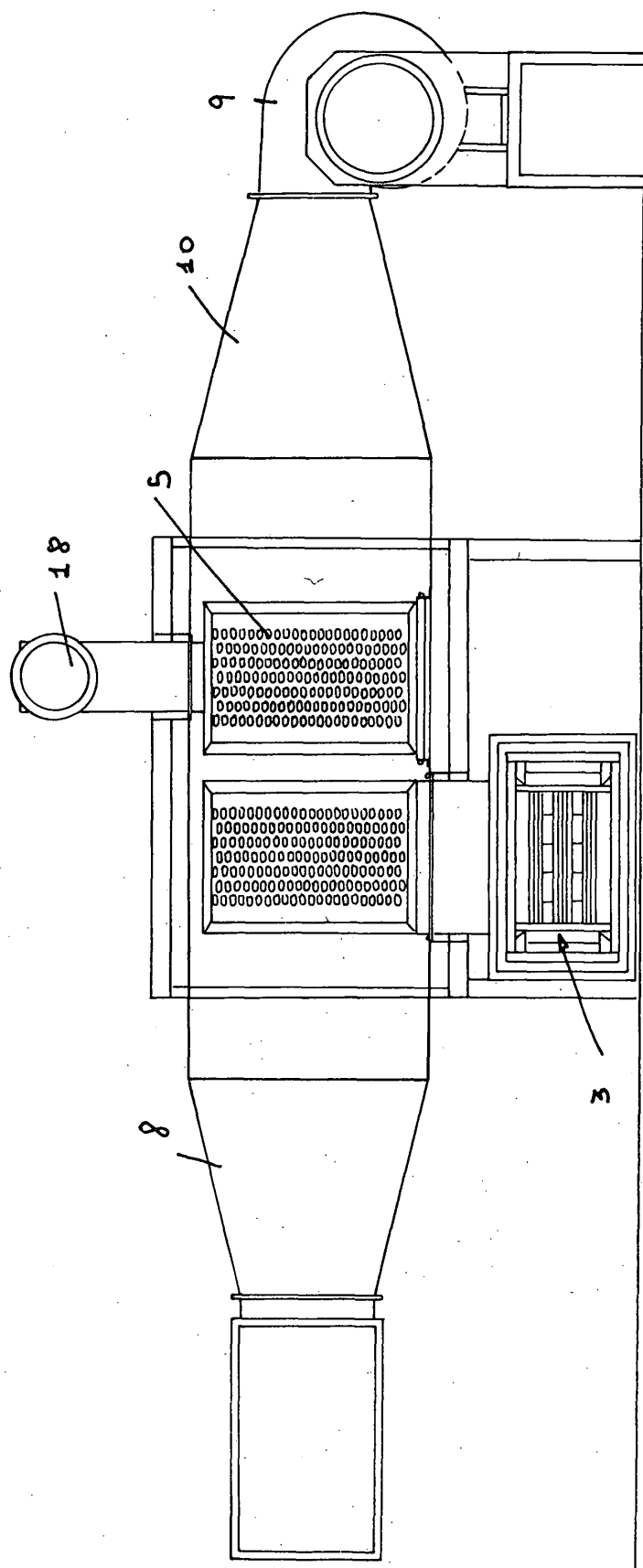


Fig. 2



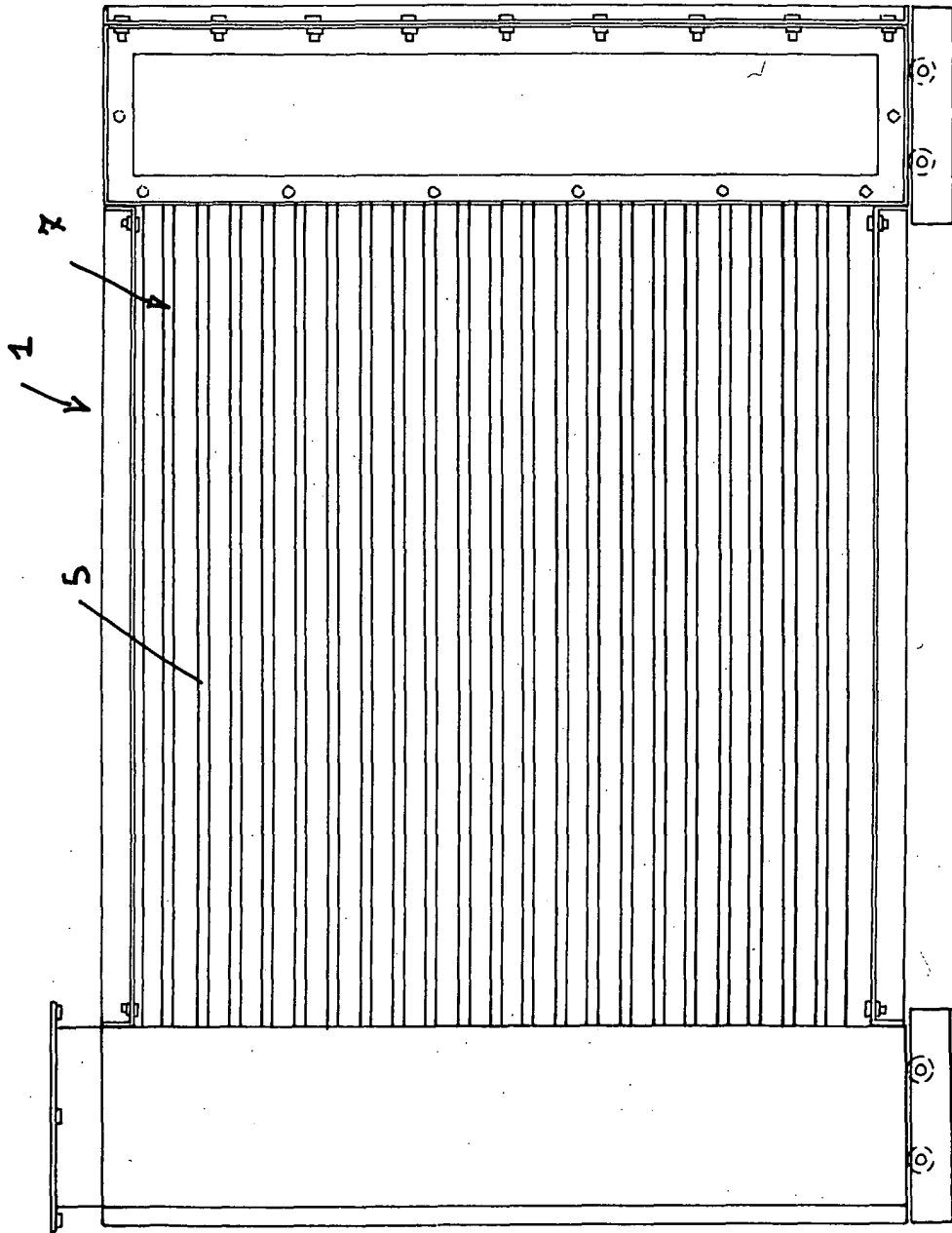


FIG. 4

